

Project Title:

A Weight of Evidence Screening Value Approach to Nutrient Criteria Development for Wadeable Streams in Aggregate Nutrient Ecoregions IX and XI: Proposed Pilot Program in Virginia

Region: III**Project Cost:**

A total of \$25,500 is needed for the 1.5-year study. Funds needed for various categories are:

| | |
|-----------------|---|
| \$12,000 | Contractual (Lab Chemistry and courier delivery service to the lab) |
| \$10,000 | Contractual (AAC) to help analyze data, write report, attend meetings |
| \$ 3,500 | Supplies |
| \$25,500 | Total |

FY07 Extramural Amount Requested:**Project Objectives:**

[What do you hope to accomplish?]

The Virginia Department of Environmental Quality (DEQ) proposes to conduct a trial run of a weight of evidence nutrient-criteria screening value approach for wadeable freshwater streams in Aggregate Nutrient Ecoregions IX and XI between March 2007 and June 2008. This approach was developed by the Water Quality Academic Advisory Committee (AAC), a scientific advisory group to DEQ. The AAC will analyze the data and make final recommendations to DEQ by September, 2008 for DEQ use in initiating a notice of intended regulatory action to develop nutrient criteria for this waterbody type.

Information from this proposed goal-oriented sampling is directly transferable to other locations within the same Nutrient Ecoregions. At the September, 2006 joint EPA Regions 2 and 3 RTAG meeting in Philadelphia, several Mid-Atlantic States indicated an interest in Virginia's proposed weight of evidence approach for determining nutrient impairments in wadeable streams.

Project Description:

[Please describe the type of work, major activities, and methodology in sufficient detail to develop a Statement of Work.]

Background:

The AAC is recommending that nutrient criteria for freshwater wadeable streams be defined using a screening-value approach (AAC, 2006); this approach employs a series of additional monitoring procedures to determine whether a waterbody is able to support the aquatic-life designated use where nutrient concentrations from routine monitoring exceed a conservative screening value. The screening value approach is applied with the intention of limiting water-quality assessment errors.

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A screening values approach is of value. Because while traditional stressors are generally toxic to organisms, nutrient enrichment effects are systemic. In addition in the variation physical and chemical characteristics of streams also affect organism responses to nutrient enrichment. As a result, biotic responses to nutrient enrichment at specific concentrations are highly variable. The screening-value approach to criteria implementation is recommended as a means of accounting for that variability.

Figure 1 summarizes the proposed approach.

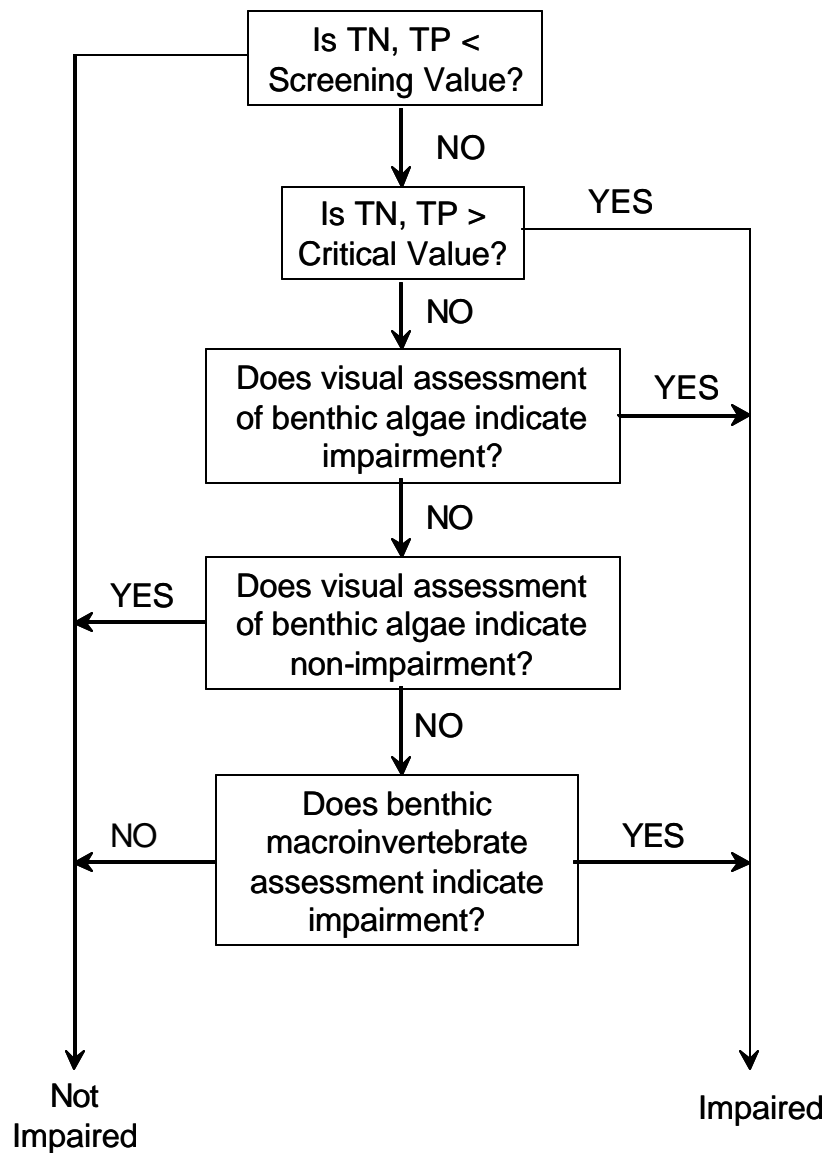


Figure 1. Proposed screening-value approach to nutrient criteria for Virginia's freshwater wadeable streams, for implementation during pilot program.

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Proposed Pilot Program:

Goals

The goals of this pilot program will be to:

- a. Develop a visual assessment procedure.
- b. Determine visual assessment levels that may trigger impairment or non-impairment designations (see Figure 1), and the levels of uncertainty that would be associated with such designations.
- c. Determine TN and TP values that can serve as screening values and as critical values (see Figure 1) and the levels of uncertainty that would be associated with such designations. See note at c.
- d. Determine the ability of the screening value approach (Figure 1) to successfully discriminate impaired from non-impaired sites using screening- and critical-values that result in reasonable resource expenditures by DEQ.
- e. Determine the resource requirements of full-scale implementation by DEQ.

Methods:

The pilot program will be conducted by applying the screening-value approach at a sub sample of ambient monitoring sites, as follows:

Spring/Summer 2007:

DEQ biologists and water quality standards staff will collaborate on development of a visual assessment procedure that can be implemented within the nutrient criteria framework (see Figure 1).

The visual assessment procedure will be designed to produce numeric results that are both reproducible and independent of the individual who is applying the method. Visual assessment components may include factors such as an estimated percentage of the visible stream bottom covered with algae or macrophytes, estimated percentage of some number of rocks removed randomly from the stream bottom that are covered with algae, the type of algae present, or similar factors. This effort will include an evaluation of the suitability of one or more of the periphyton protocols discussed in Barbour, Gerritsen, and Stribling,(1999) such as an autotrophic index, composite samples for algal biomass (chlorophyll *a* and ash-free dry mass), and field-based rapid periphyton survey. The numeric results may be expressed as a score calculated using on-site observations, or as a physical measurement such as the percentage of stream-bottom covered.

DEQ biologists and water quality standards staff will develop these methods working closely with the AAC. Should more than one candidate procedure be developed, these candidate procedures will be tested for correspondence with the Virginia Stream Condition Index for Non-

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Coastal Streams (VA-SCI) for benthic macroinvertebrate data and/or biotic impairment metrics during the Fall 2007 and Spring 2008 activities.

Late Summer 2007:

Sites to be included in Fall 2007 pilot program implementation will be selected using the following method:

1. Identify all ambient water-quality monitoring sites meeting either of the following two conditions:
 - a.) For sites that have been in operation continuously during the previous 12 months, 5 or more TN and 5 or more TP concentrations recorded during the previous 12 months.
 - b.) For sites that have been in operation continuously only since January 2007, 3 or more TN and 3 or more TP concentrations recorded since January 2007.
2. DEQ biologists identify those sites which they know to be affected by non-nutrient stressors, such as sedimentation, urban runoff, or direct effects of a major point-source discharge. These sites will be removed from the pool of sites considered as eligible for the pilot program.
3. Determine the number of sites that can be reasonably assessed. (Approximately 20 sites for each of the two sampling periods for a total of 40 sites are anticipated.).
4. Using median TN and TP values calculated from monitoring observations collected during the prior 12 months, define TN and TP concentration ranges to be used for site selection, considering the number of sites that resources are available to assess.

For example: TP concentrations ranges may be:

TP = 0.01 mg/L
0.01 < TP = 0.03 mg/L
0.03 < TP = 0.05 mg/L
0.05 < TP = 0.07 mg/L
0.07 < TP = 0.1 mg/L
TP > 0.1 mg/L

It is essential that the same concentration ranges be used within each region.

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5. Within each region, use a randomized procedure to select monitoring sites so that each nutrient concentration range is represented by at least 1 site.

This process would proceed by (a) using a randomized process to select one site within each TN concentration range, then (b) using a randomized process to select one site within each TP concentration range that has not already been “occupied” by the TN-selection process.

Fall 2007:

DEQ Biologists will conduct both a visual assessment and a benthic macroinvertebrate assessment at each of the sites selected for study implementation. A visual assessment score and a stream condition index score will be recorded for each location. Other site attributes relevant to the potential nutrient effects, such as amount of shading (full shade, partial shade, full sun), estimated surface stream velocity (slow, moderate, fast), stream substrate (sand, gravel, cobble), stream depth and width, will be recorded on a field survey form..

All sampling will be conducted according to established VADEQ protocols as detailed in VADEQ Standard Operating Procedures (SOP) manuals.

In-situ Measures:

- Temperature - In-Situ, YSI or Hydro-Lab multi-probe meter (calibrated with NIST thermometer in lab).
- pH – In-Situ, YSI or Hydro-Lab multi-probe meters (calibrated and post-confirmed checked each field day, using commercially available standards)
- Dissolved oxygen –In-Situ, YSI or Hydro-Lab meter (pre-calibrated and post-confirmed each field day, using (100% RH) air standard)
- Conductivity- In-Situ, YSI or Hydro-Lab meter (calibrated and post-confirmed each field day, using commercially available standards)

In addition to these field measures, water chemistry parameters will be analyzed including: nitrate, total nitrogen, TKN, ammonia, total phosphorus, suspended solids and turbidity. Periphyton (algae) sampling will be conducted to estimate algal biomass: chlorophyll a (chl a), ash-free dry mass (AFDM). Chlorophyll a and AFDM analyses will be conducted by the Virginia DCLS laboratories following Standard Methods (APHA 1992) for algal biomass estimates.

Early Winter 2007/2008:

Data from the fall sampling will be assembled and made available to the AAC and to interested parties within DEQ for analysis.

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Late Winter 2007/2008:

The Summer 2007 site selection process will be repeated using the prior 12 months data to select Spring 2008 sites. However, a defined number of sites that were monitored in the Fall 2007 will be repeated so as to determine the stability of results.

Spring 2008:

The Fall 2007 procedures will be repeated with the new set of sites.

Early Summer – September 2008:

Data from the spring sampling will be assembled and made available to the AAC and to interested parties within DEQ for analysis. AAC (working with other parties from DEQ who have an interest) will analyze fall and spring data and draw conclusions.

Project Outcomes:

[How will the work advance the progress towards adopting water quality standard for the state, territory, or authorized tribe? At what stage in the criteria development process will the state, territory, or tribe be as a result of this work? When will the state, territory or tribe reach this stage? Does this progress affect classes of waters or just selected waters? Does this progress address nitrogen, phosphorus, chlorophyll and transparency, or just some of these parameters?]

Virginia DEQ, in collaboration with an Academic Advisory Committee, has completed (AAC, 2006) the planning phase for the localized component of nutrient criteria development for wadeable streams in the Piedmont and Mountain regions of Virginia (Aggregate Nutrient Ecoregions IX and XI). (An AAC recommended approach for developing nutrient criteria for the localized component of nonwadeable freshwater streams is anticipated in June, 2007). The Department is now ready to initiate the data gathering and subsequent data analysis stage with the goal of having AAC data analysis and final recommendations for a weight of evidence regulatory approach for identifying localized nutrient impairments in wadeable streams in the Piedmont and Mountain regions of Virginia (Aggregate Nutrient Ecoregions IX and XI). This process will address evaluation of all four primary variables for nutrient criteria developments (nitrogen, phosphorus, chlorophyll, and transparency). The AAC has already recommended a narrative approach to addressing downstream effects in freshwater streams in these two nutrient ecoregions.

The results of the pilot program should allow DEQ and the AAC to determine the feasibility of implementing nutrient criteria that include a screening-value approach. In particular, we will be able to assess if the screening value approach allows nutrient-criteria implementation with fewer assessment errors than would be likely through a traditional fixed threshold nutrient criteria approach. We can also assess the degree of improved accuracy and the cost of implementing this approach.

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If the screening-value approach is determined to be feasible, the pilot program results can be used to determine nutrient concentrations that can serve as screening values and as critical values. If several visual assessment processes are applied on a trial basis during the pilot program, the program results can allow the best of these options to be identified.

If the screening-value approach is determined to not be feasible, pilot program results can be considered along with other monitoring data in developing a fall back position, such as a traditional fixed-threshold or an alternative approach.

Timeline and Major Milestones:

[Please indicate when you will be able to begin work on the project (factoring in any applicable time to process work assignments or fund a grant), when you will likely complete the project, and identify the major milestones.]

A project timeline is attached in an Excel spreadsheet format.

Financial Management:

[Do you have a contract vehicle in place that is readily available? If not, do you need assistance identifying a HQ contract? Do you have a currently certified Work Assignment Manager or IAG/Grant Project Officer to manage the work? How much experience with contracts and IAGs/grants does the region have?]

Contract or Region 3 WAM

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